

Are The Technical Skills of Junior URL Officers Eroding?

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- ⇒ **Common perception is that technical skills of new JO's are eroding.**
- ⇒ **Number of new Ensigns with technical undergraduate degrees fell from a peak in 1988 to 2001:**
 - Number of technical (engineering, math, science) degrees fell from 4,910 to 1,450 (by 70.5%)
- ⇒ **Increasing technological sophistication of ships and airplanes suggests demand for technical skills is growing**
 - Aegis weapons control system on cruisers and new destroyers
 - Enhanced communications systems with Battlefield Dominance strategies
 - Replacement of weapons platforms with newest generation of ships and planes

BACKGROUND (Continued)

- What is the *required level* of “Technical Knowledge” for JO’s in URL:
 - to motivate, lead, and communicate with enlisted personnel in technical ratings, and
 - to manage divisions and squadrons.
- Is a mechanical or electrical engineering degree necessary to be a successful division officer?
- The study examines trends in JO’s with technical backgrounds, including:
 - their composition in the URL,
 - their source of commissioning,
 - their propensity to fill technical billets,
 - their on-the-job performance.

METHODOLOGY

- We define “Technical Knowledge” in two dimensions to capture the continuum of technical skills and knowledge:
 1. **General Technical Knowledge** acquired in core mathematics and science courses*
 - (a) Cumulative grade point average of 2.20 or higher (i.e., $APC1 \leq 3$), and
 - (b) Grade of C+ or better in calculus sequence (i.e., $APC2 \leq 2$), and
 - (c) Grade of C+ or better in physics sequence (i.e., $APC3 \leq 3$).
 2. **Specific Technical Knowledge** acquired via technical major in:
 - (a) Engineering
 - (b) Architecture
 - (c) Physical Sciences
 - (d) Mathematics, Operations Analysis, etc.
 - (e) Computer Sciences, Information Technical, etc.

*NOTE: *These are the minimal technical core requirements set by the Naval*

TRENDS IN TECHNICAL MAJORS OF ENSIGNS:

All-Volunteer Force to end of Reagan Build-up (1978-1989):

Percent of URL Ensigns with known technical undergraduate major rose from 50%
to 60%

The Draw-down (1989-2001):

Percent of URL Ensigns with known technical major fell slightly from 55% to 50%

Percent of engineering majors steady at 34-35%

Percent math/science majors fell from 25% to 15%

Overall:

Recent declines characterizes all three major commissioning sources - with the greatest variation in OCS, followed by NROTC, and the least variation in USNA.

Percent of URL Ensigns with known technical major constant over entire period (1978-2001)

TRENDS IN TECHNICAL SKILLS OF LTjgs

- 1977-1997 the percent of URL Ensigns with “strong” general technical skills (APC \geq 3-2-3) rose from 40% to 50%.
- The historical pattern of “strong” general technical skills characterizes all commissioning sources -- with the greatest variation seen in OCS, followed by NROTC, and the least in USNA.
- 90% of submariners have a “strong” general technical skills; but, the percent of surface and aviation JO's with strong general skills also rose from 30% to 40%.
- 80% of those with a “strong” general technical skills also have a technical major
- Percent of officers with strong technical skills falls in higher grades—42% at 0-4; 39% of 0-5; to 37% of 0-6.

Analytical Approach

- Analyze predictors of technical skill acquisition
- Estimate statistical models of the impact of “Technical Skills” on JO career milestones:
 - Probability of Completing Nuclear Power Training.
 - Continuation Rates
 - Graduate Education
 - Lateral Transfer to AEDO or CEC
 - Attainment of SWO Qualification
 - Job Performance (based on fitreps)
 - Promotion Probability to O-4

Predictors of “Strong” Technical Skills

- NROTC & OCS graduates are 10% - 25% less likely to have strong technical skills (compared to USNA).
- Graduates of highly selective colleges are 2-3 times as likely to have strong technical skills as those from less competitive colleges.
- Prior enlisted are 20% more likely to have strong technical skills
- Minorities are 10% less likely to have strong technical skills compared to majority JO's.

Model #1: **Technical Skills and Nuclear Power Training**

- Percent of technical JO's choosing nuclear power option has fallen (from 45% to 30%).
- Since 1992 USNA has graduated about same number of nuclear-trained JO's while NROTC and OCS have graduated far fewer.
- Those with strong technical skills are 30% more likely to become nuclear power qualified. This effect is increased another 10%-points if one has technical major.
- Given strong technical skills:
 - NROTC graduates are slightly less (3-4%) likely to complete nuclear power training
 - OCS graduates are more likely (8%) to become nuclear power trained (than USNA graduates).

Model #2: **Effect of Technical Skills on Retention**

- Graduates with strong technical skills are slightly less likely (4%) to stay to O-4
- A technical degree has no additional effect on retention.
- NROTC and OCS graduates of highly selective colleges are 10% and 20%, respectively, less likely to stay (than USNA graduates).
- Prior enlisted are roughly 30% more likely to stay.

Model #3: **Technical Skills and Graduate Education**

- Percent completing technical graduate degree rose from 10% to 20% during '77 - '84, but then leveled off through '87, and fell thereafter.
- JO's with strong technical skills are 10%-15% more likely to complete a technical graduate degree - those with a technical major are an additional 10% more likely to acquire a technical graduate degree.
- Given one's technical degree or skills, neither commissioning source nor college quality affects likelihood of a technical graduate degree.

Model #4: **Technical Skills and Lateral Transfers to (A)EDO and CEC**

- JO's with strong technical skill base are more likely (5% to 8%) to laterally transfer into EDO-CEC communities
- JO's who also have technical major are an additional 6% more likely to transfer

Model #5: **Technical Skills and SWO Qualification**

- The major split in time to earning one's SWO Pin is between one to two years after being assigned to a ship.
- Those earning SWO Pin in the first year are 10% more likely to promote to LCDR than those earning their pin later.
 - Time-to-qualify appears to indicate greater productivity on-the-job.
- Those with “strong” technical skills are 10% more likely to earn SWO pin in first year (if they have a technical major).
- On average, OCS grads take two to three months longer to earn their SWO Pin (compared to USNA graduates) – with those from less selective colleges taking even longer to qualify.

Model #6: **Technical Skills and Job Performance**

- Measure performance based on observed fitness reports: 'superior' = if $\leq 75\%$ of fitness reports are 'RAP'd'
- Officers with strong general technical skills are 2% to 3% more likely to earn superior fitness report scores as O-3's, regardless of undergraduate major.
- Given technical skills, technical major has no additional effect on early career fitness reports and a small negative effect on O-3 fitreps (-1.5% fewer superior fitreps).
- NROTC and OCS graduates receive from 3%-5% fewer superior O-3 fitreps as O-1/O-2, and 5%-10% fewer as O-3 (compared to USNA grads)
- NROTC and OCS grads from highly selective colleges have comparable performance to USNA grads on early career fitreps.

Model #7: **Technical Skills and Promotion to LCDR**

- JO's with "strong" general technical skills who stay are 4% more likely to promote to O-4. This "promotion premium" seems relatively small given the perceived need for such technical skills in today's Navy.
- It is also surprising that the specific knowledge from a technical major (given general tech skills) does not affect promotion in URL.

SUMMARY AND CONCLUSIONS

- **The observed decline in the number of technically trained JO's reveals that:**
 - The number of officers with a technical degree varies with overall force structure. Over the last 30 years, the percentage of O-1 and O-2's with a technical degree has remained constant.
 - Moreover, percent of Ensign's with general technical background has grown over the last 20 years
- **JO's with strong general technical skills:**
 - More likely to choose nuclear power
 - More likely to earn technical graduate degree
 - Have slightly higher performance scores
 - Have slightly higher promotion rates to O-4

SUMMARY & CONCLUSIONS (Continued)

JO's who acquire more specific technical knowledge via a technical major:

- Increase chances of acquiring a technical graduate degree
- Are more likely to laterally transfer to (aviation) engineering duty officer community or civil engineering corps
- Earn SWO qualification faster.

JO's with general and/or specific technical knowledge are slightly less likely to continue on active duty.

If URL community managers wish to expand the numbers of JO's with general and/or specific technical knowledge skills, will need special recruiting efforts to attract individuals from more selective colleges, especially minorities and females.

SUMMARY & CONCLUSION (Continued)

- Suggest bonus for OCS grads with minimum technical skills (APC \leq 3-2-3)
- Provide Grad-Ed brief to all seniors at USNA and VTC brief to NROTC grads
- Offer technical remediation courses at facilities prior to being sent to NPS for resident technical grad ed programs
- Additional resources must be directed to resuscitate NPS efforts to identify the general and specific technical skills of the vast majority of URL officers entering the fleet each year.

BACK-UP SLIDES

Data Issues

- Problems with missing information
 - Missing undergrad major
 - USNA about 5%
 - NROTC missing 15% in 1988, 30% in 2001
 - OCS missing 25% in 1988, 80% in 2001
 - Missing APC (general tech skills)
 - USNA about 5%
 - NROTC missing 18% in 1988, 26% in 2001
 - OCS missing 20% in 1988, 95% in 2001

METHODOLOGY (Continued)

- **The analysis is based on the benefits to the Navy from its investments in the technical skills of JO's:**
 1. The ability of the Navy to *"fill"* certain jobs and communities:
 - a. nuclear power qualified junior officers;
 - b. technical graduate degree programs sponsored by the Navy and the corresponding technical sub-specialty billets; and
 - c. lateral entry into the (aviation) engineering duty officer and civil engineering corps communities.
 2. Improved *on-the-job performance*, as measured by:
 - a. shorter training period to become warfare qualified;
 - b. higher scores on competitive fitness reports; and
 - c. higher promotion rates.